Regional Economic Model for Drought, Energy Policy, and the Food-Energy-Water Nexus in Texas

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BACKGROUND

The increasing frequency and severity of drought has profound implications for the food-energy-water (FEW) nexus. While the energy and food industries are clearly negatively impacted by drought, the relative magnitudes of the damage are not clear. Several open questions exist. First, whether it is welfare improving to focus policy on cutting water consumption by the energy industry or to focus on reducing water use in the agricultural industry, and how policy would impact these inter-related sectors. Further, as fuel costs and environmental regulations change, this may alter the value of water for use in energy production, and alter the incomes and purchasing decisions of households. For example, energy policy may cause the mix of electricity generators on the grid to move toward renewable sources of energy – in turn this reduces the average water use per megawatt of electricity generated, and will affect water availability in other sectors. Also, if energy or agricultural costs increase due to drought, this may crowd out other economic activity in other sectors, as consumers spend a larger share of their incomes on these goods. Other effects that can be evaluated with this modeling framework include how changing pathways of emissions can alter atmospheric water conditions (and thus water availability), agricultural water demands and crop yields, aquifer pumping and storage, and household heating and cooling decisions. In the same vein, the model can capture the effect that changes in electricity grid capital will have on emissions pathways, and these subsequent effects.

OBJECTIVES

- Develop an electricity dispatch model for the Texas ERCOT electricity grid with modules for plant-specific water use and greenhouse gas emissions.
- Develop a regional Computable General Equilibrium (CGE) model of a specific Texas water basins, including electricity, natural gas production, agricultural production, and consumer behavior.
- Develop a surface-subsurface hydrology model of water availability for the selected basin.
- Integrate the modeling components to create an operations/decision making module to examine policy outcomes.
- Demonstrate the effects of drought, energy policy, and climate change on consumer welfare, sectoral water availability, aquifer pumping decisions, brackish water and desalination policy, and greenhouse gas emissions under varying policy and climate scenarios.